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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/890,864	12/21/2001	Wulf Haussler	212603US6	8019

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OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C.
1940 DUKE STREET
ALEXANDRIA, VA 22314

EXAMINER

MUTSCHLER, BRIAN L

ART UNIT	PAPER NUMBER
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1753

14

DATE MAILED: 02/14/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/890,864

Applicant(s)

HAUSSLER ET AL.

Examiner

Brian L. Mutschler

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 January 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 15-44 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 15-44 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 8.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Comments

1. The objection to the specification has been overcome by Applicant's amendment.
2. The rejection of claims 16, 18 and 26 under 35 U.S.C. 112, first paragraph, has been withdrawn. Although the claim language is not as clear as would be desired, it is understood that one skilled in the art would recognize that the dielectric layer would inherently be doped, as suggested in the specification in lines 18-22 on page 3, wherein the specification states, "It has also been observed...the window layer of ZnO made conductive by doping." One skilled in the art would recognize that the term "dielectric," while by definition meaning a nonconductive material, is a term describing the undoped form of an oxide or nitride made conductive by doping for use in the electrode.
3. The rejection of claims 15-28 under 35 U.S.C. 112, second paragraph, has been overcome by Applicant's amendment.
4. The novelty of the instant invention appears to be the dimensions of the window electrode, as presented in added claims 29-44. On page 6 of the instant disclosure, it states, "successions of layers comprising two dielectric layers with an intermediate metallic layer (functional layer) are generally known." New rejections addressing the new claims are therefore presented below.

Information Disclosure Statement

5. The information disclosure statement filed on January 2, 2002, has been considered.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

7. Claim 31 and 42 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claims 31 and 42 recite the limitation "wherein the antireflective layer comprises a layer of refractive oxide covered by a layer of nitride." This limitation raises the issue of new matter because the specification does not provide support for a layer comprising an oxide layer covered by a nitride layer. The antireflective layer was only described as comprising at least one layer of an oxide or a nitride (see page 4 beginning at line 9 in the instant specification).

*Does provide oxide and/or a nitride
original claim 6*

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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9. Claims 15-20, 22, 24-26 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Weber et al. (U.S. Pat. No. 4,940,495) in view of Chen et al. (U.S. Pat. No. 5,078,804).

Weber et al. disclose a light transmitting electrically conductive stacked film for use in solar cells. The stacked film **18** comprises a first conductive oxide layer **22** and a second conductive oxide layer **24**, with a metallic film layer **26** interposed between the layers (col. 2, lines 56-66). An optional encapsulant layer **20** maintains a reduced reflection and increased transmission of the solar cell (col. 3, lines 53-55). The conductive oxide layers **22** and **24** are preferably made of ZnO, SnO₂ or TiO₂, and have a high index of refraction (col. 3, line 56 to col. 4, line 1). The metal layer **26** is preferably made of silver (col. 4, lines 16-25). In Example 2, Weber et al. disclose a window electrode having a silver layer with a thickness of 8 nm, and a total thickness of 93 nm (col. 6, lines 56-63). Furthermore, Weber et al. disclose the benefits additional layers to create "an even more efficient top conductive contact", wherein "the multiples of stacked films which may be employed are limited primarily by absorption in the silver and oxide films" (col. 7, lines 8-10 and lines 53-55).

The solar cell of Weber et al. differs from the instant invention because Weber et al. do not disclose the following:

- a. The absorber is a CIS or chalcopyrite layer, as recited in claims 15 and 28;
- b. An antireflective layer on the light-incident side of the window electrode, as recited in claim 15; and

? no longer
claimed

- c. The window electrode comprises a first refractive layer, a first metallic layer, a second refractive layer, a second metallic layer, and an antireflective layer formed in succession, as recited in claim 19.

Regarding claims 15 and 28, Chen et al. disclose the use of an antireflective layer 70 on a solar cell containing a window electrode comprising layers of conductive and refractive zinc oxide layers 50 and metallic layers 60 (fig. 1 and 2). Chen et al. further disclose the use of a CIGS solar cell, a quaternary analog to CIS solar cells (col. 1, lines 53-56).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the device of Weber et al. to use an antireflective coating, as taught by Chen et al., because using an antireflective coating increases the amount of sunlight that reaches the semiconductor layer, which increases the photoelectric conversion efficiency.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the device of Weber et al. to use a CIS based solar cell, as taught by Chen et al., because CIS and CIGS solar cells have a higher efficiency than silicon solar cells.

Regarding claim 19, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the device of Weber et al. to use a second metallic layer between the second refractive layer and the antireflective

layer because Weber et al. teach that the use of multiple metallic layers result in a more efficient top conductive contact (col. 7, lines 8-10).

The method of making the solar cell having the limitations described above is inherent because the method contains the same limitations recited in the apparatus claims.

10. Claims 15-22, 24-27, 29-31, 33-40, 42 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Berman et al. (U.S. Pat. No. 4,663,495) in view of Arimoto (U.S. Pat. No. 6,071,753).

Regarding claims 15, 24 and 33, Berman et al. disclose a thin-film solar cell **10** comprising an absorber layer **12** and a transparent window electrode layer **14** having a metallic layer and an oxide layer formed between the absorber layer and the metallic layer (col. 3, lines 49-63; col. 9, lines 20-35).

Regarding claims 16-18, 20, 21, 25-27, 34-36, 38 and 39, both the front electrode **14** and a rear electrode **16** comprise a stack structure formed by a pair of ZnO layers on either side of a silver layer (col. 9, lines 20-35).

Regarding claims 19 and 37, Berman et al. disclose that a stacked structure **132** of metallic layer **134** and a metallic oxide layer **136** "may be repeated a number of times to increase conductivity" (col. 10, lines 16-17).

Regarding claims 22, 29, 30, 33, 40 and 44, the ZnO layers have a thickness ranging from 400-1000 angstroms (40-100 nm) and the silver layer has a thickness of 50-200 angstroms (5-20 nm) (col. 9, lines 20-35).

The solar cell of Berman et al. differs from the instant invention because Berman et al. do not disclose the use of an antireflective layer, as recited in claims 15, 24, 31, 33 and 42.

Antireflective layers are commonly used to increase the amount of light absorbed by solar cells to increase the overall conversion efficiency. Arimoto discloses a solar cell using an antireflective layer comprised of a nitride or oxide film and having a thickness in the range of several hundred to 1000 angstroms (col. 8, line 65 to col. 9, line 3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the solar cell of Berman et al. to use an antireflective layer as taught by Arimoto because an antireflective coating would increase the conversion efficiency of the solar cell.

The overall thickness of the window electrode would be less than 120 nm using the combination of Berman et al. and Arimoto.

Regarding claims 31 and 42, using silicon nitride as taught by Arimoto would provide a structure comprising a layer of nitride covering an oxide layer, as recited in the instant claims.

The method for making the solar cell is inherently taught by Berman et al. and Arimoto because the only way to produce a solar cell having the taught structure would be through the use of the claimed method.

11. Claims 21 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Weber et al. (U.S. Pat. No. 4,940,495) in view of Chen et al. (U.S. Pat. No. 5,078,804), as applied above to claims 15-20, 22, 24-26 and 28, and further in view of Nath et al. (U.S. Pat. No. 5,176,758).

Weber et al. and Chen et al. describe a solar cell and method for making the solar cell having the limitations recited in claims 15-20, 22, 24-26 and 28 of the instant invention, as explained above in section 9.

The apparatus and method described by Weber et al. and Chen et al. differ from the instant invention because they do not disclose the formation of a second electrode comprising at least one metallic layer and one refractive layer.

Nath et al. disclose a light-transmissive solar cell comprising transparent electrodes on both sides of the device (col. 2, lines 3-11).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the device described by Weber et al. and Chen et al. to use a second transparent electrode similar to the first transparent electrode because Nath et al. teaches the formation of transparent electrodes on both sides of a solar cell, yielding a device which can absorb light from both sides of the solar cell or transmit light through the cell.

12. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Weber et al. (U.S. Pat. No. 4,940,495) in view of Chen et al. (U.S. Pat. No. 5,078,804), as applied above to claims 15-20, 22, 24-26 and 28, and further in view of Yamazaki (U.S. Pat. No. Re. 33,208).

Weber et al. and Chen et al. describe a solar cell and method for making the solar cell having the limitations recited in claims 15-20, 22, 24-26 and 28 of the instant invention, as explained above in section 9.

The apparatus and method described by Weber et al. and Chen et al. differ from the instant invention because they do not disclose a blocking layer between the metallic layer and the refractive layer.

Yamazaki discloses the use of a blocking layer as a means for preventing impurities from entering the active regions of the solar cell (col. 4, line 18).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the device described by Weber et al. and Chen et al. to use a blocking layer, as taught by Yamazaki, because using a blocking layer would prevent impurities from reaching the active regions of the solar cell.

13. Claims 23 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Berman et al. (U.S. Pat. No. 4,663,495) in view of Arimoto (U.S. Pat. No. 6,071,753), as applied above to claims 15-22, 24-27, 29-31, 33-40, 42 and 44, and further in view of Yamazaki (U.S. Pat. No. Re. 33,208).

Berman et al. and Arimoto describe a solar cell having the limitations recited in claims 15-22, 24-27, 29-31, 33-40, 42 and 44 of the instant invention, as explained above in section 10.

The solar cell described by Berman et al. and Arimoto differs from the instant invention because they do not disclose the device comprising a blocking layer between the metallic layer and the refractive layer.

Yamazaki discloses the use of a blocking layer as a means for preventing impurities from entering the active regions of the solar cell (col. 4, line 18).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the device described by Berman et al. and Arimoto to use a blocking layer, as taught by Yamazaki, because using a blocking layer would prevent impurities from reaching the active regions of the solar cell.

14. Claims 28, 32 and 43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Berman et al. (U.S. Pat. No. 4,663,495) in view of Arimoto (U.S. Pat. No. 6,071,753), as applied above to claims 15-22, 24-27, 29-31, 33-40, 42 and 44, and further in view of Chen et al. (U.S. Pat. No. 5,078,804).

Berman et al. and Arimoto describe a solar cell having the limitations recited in claims 15-22, 24-27, 29-31, 33-40, 42 and 44 of the instant invention, as explained above in section 10. Berman et al. also disclose that the solar cell "may contain any suitable photovoltaic material defining a photojunction for conversion of light to electrical energy" (col. 6, lines 50-52). Silicon is disclosed as a specific example

The solar cell described by Berman et al. and Arimoto differs from the instant invention because they do not disclose the absorber comprising a chalcopyrite, as recited in claim 28, or forming the absorber of a CIS structure, as recited in claims 32 and 43.

Chen et al. disclose the use of an antireflective layer **70** on a solar cell containing a window electrode comprising layers of conductive and refractive zinc oxide layers **50** and metallic layers **60** (fig. 1 and 2). Chen et al. further disclose the use of a CIGS solar cell, a quaternary analog to CIS solar cells (col. 1, lines 53-56).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the solar cell described by Berman et al. and Arimoto to use a CIS based solar cell, as taught by Chen et al., because CIS and CIGS solar cells have a higher efficiency than silicon solar cells and are suitable materials for forming photojunctions.

Response to Arguments

15. Applicant's arguments filed January 2, 2003, have been fully considered but they are not persuasive.

16. Regarding the rejection of the claims, Applicant has argued that Weber et al. differs from the instant invention because Weber et al. does not teach the oxide layers having a thickness of 30-50 nm (see page 8 of Applicant's response).

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17. Regarding claims 15-28, the thickness of the oxide layers was never claimed, and is still not presented in those claims. Therefore, the argument is not based on claimed subject matter.

18. The new rejections based on Berman et al. and Arimoto address the limitations regarding the thickness of the oxide layers presented in the new claims.

Conclusion

19. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

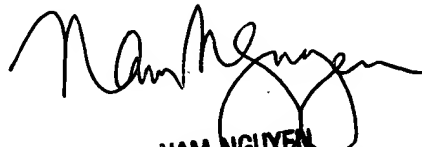
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian L. Mutschler whose telephone number is (703)

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305-0180. The examiner can normally be reached on Monday-Friday from 8:00am to 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (703) 308-3322. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.


NAM NGUYEN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

blm
February 12, 2003